# Project-Level Friction: Critical Success Factors for Sustainable Water Governance in Botswana

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## ABSTRACT

In many semi-arid and developing countries like Botswana, sustainable delivery of water infrastructure projects remains a persistent challenge exacerbated by climate change, recurrent project delays, cost overruns, and operational failures despite many countries having established policy frameworks. This study analyses the systemic factors influencing water sector project performance in Botswana, concentrating on practitioners' understanding of national water and environmental frameworks, critical success factors (CSFs), and sustainability-related implementation gaps influencing project delivery. Conceptualising these challenges as manifestations of "project-level friction", the misalignment between policy intent and execution capacity, the study examines where and why such friction emerges. A mixed methods research design was adopted, integrating a structured questionnaire survey sent via email to water sector professionals. The study's quantitative data were analysed using descriptive statistics, ranking techniques (RII), and correlation analysis, while qualitative data were subjected to thematic analysis utilising NVivo. The study results indicate that there is a considerable level of knowledge among practitioners about regulatory frameworks, and they also underscore insufficient integration of sustainability principles into day-to-day project management practices. The study reveals key challenges that impact water sector project completion through institutional fragmentation, insufficient technical expertise, and inconsistent regulatory enforcement. The study results indicate a strong positive correlation between policy literacy, stakeholder engagement, and perceived project effectiveness ($\rho>0.70$). In addition, the study findings indicate that underperformance in project delivery is a result of shortcomings in governance, leadership, and execution, rather than technical inadequacy. The study offers valuable insights to guide policy development, institutional strengthening, and capacity-building efforts. It emphasizes the need for proportional investment in governance and human capital alongside physical infrastructure to achieve water sustainability in Botswana and similar semi-arid contexts.

**Keywords:** Project-level friction; Critical Success Factors; Implementation gap; Water resources management; Project governance; Botswana; Semi-arid countries. **JEL Classification:** O22; Q25; D73

## INTRODUCTION

In arid regions like Botswana, water management is vital for development as scarcity increases alongside agricultural and industrial demand (Kinzelbach et al., 2010; Biswas, 2008; Dirwai, et al., 2021). Despite frameworks like the Botswana Integrated Water Resources Management and Water Efficiency (IWRMWE) Plan and the Regional Water Policy for the Southern African Development Community (SADC), projects are plagued by delays and underperformance (Adeyemi & Masalila, 2016; Kaboyakgosi & Marata, 2015). These recurring issues suggest that governance gaps and capacity constraints, rather than poor policy intent, are the primary challenges (Mokalobotho, et al., 2018; Kgathi, 2004; Motsholapheko et al., 2018). Chronic disconnects between stated policy objectives and on-the-ground delivery—conceptualised here as project-level friction—intensify at the operational interfaces where governance structures, inter-agency coordination, and institutional capacity intersect with day-to-day implementation processes.

Pressure on water resources in semi-arid regions has increased due to climate variability, rapid urbanisation, and rising multi-sector demands. Recent research suggests advanced technologies—IoT monitoring, AI groundwater mapping, smart metering, solar systems, and nature-based solutions—could boost water management efficiency and resilience (Dai et al., 2025). However, in developing nations, high costs, complex integration, poor institutional coordination, and limited standardisation often hinder the adoption of such innovations (Humnabadkar et al., 2018). Consequently, technology alone is insufficient for sustainable project outcomes.

Successful water project delivery depends on the interplay of human, institutional, and managerial factors. Key performance drivers include policy literacy, leadership, collaborative governance, and stakeholder engagement (Al-Mharmah, 2000; Belassi & Tukel, 1996; Motsamai & Moalafhi, 2019). Conversely, inconsistent management standards, institutional fragmentation, and skill shortages often result in stalled or abandoned projects (Kgengwenyane, 2011; World Bank, 2018b). These persistent failures highlight the need to evaluate project sustainability through the lens of management and governance, and to diagnose where friction accumulates within project systems.

Project management research has shifted focus from traditional cost, time, and scope control to long-term sustainability outcomes (Müller et al., 2007; Too & Weaver, 2014; World Bank, 2018). Decisions made during planning, procurement, coordination, and engagement phases are now critical for effectiveness and resilience. Consequently, identifying Critical Success Factors (CSFs) has become a central research concern (Müller et al., 2007; Too & Weaver, 2014). While evidence by Gündüz et al. (2020) confirms the importance of planning and coordination, most CSF studies remain concentrated in construction and transport, with limited application to water projects in developing and semi-arid contexts (Mir & Pinnington, 2014).

In Botswana and the broader Southern African region, there is a lack of empirical research linking project management to sustainable water outcomes. Most existing studies prioritise policy frameworks (Moyo, 2019), institutional reforms, and resource constraints, overlooking how practitioners actually apply and operationalise management principles (Government of Botswana, 2012; National Water Policy, 2013; Mogomotsi et al., 2018). This gap leaves unexamined the specific points of friction where policy intent fails to translate into execution reality. This research gap hinders the creation of context-specific interventions and undermines the success of national water strategies.

This study examines how project management practices shape water project sustainability in Botswana, focusing on policy awareness, systemic challenges, and Critical Success Factors (CSFs). Taking a managerial perspective, it recognises that leadership, institutional coordination, stakeholder engagement, and regulatory compliance are more vital to sustainable outcomes than technical solutions alone. By adopting a friction lens, the study seeks not only to identify success factors but to diagnose where and why implementation gaps emerge—laying the groundwork for a broader framework that examines friction at project, institutional, and household scales.

To achieve this, the study pursues four specific objectives (SO):

- i assessing practitioners' awareness of national water and environmental policies;
- ii analysing systemic constraints on project sustainability; identifying and prioritising CSFs for project performance;
- iii identifying and prioritising Critical Success Factors (CSFs) for project performance; and
- iv analysing alignment gaps between current management practices and sector sustainability goals.

The rest of the paper is organised as follows: Section 2 reviews literature on project management and sustainable water development, focusing on CSFs and governance challenges in semi-arid regions. Section 3 details the research methodology, including design, case study justification, data collection, and ethics. Section 4 presents the empirical findings, covering respondent profiles, CSF rankings, and systemic challenges. Section 5 concludes with key findings and recommendations for improving water sector project delivery.

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# LITERATURE REVIEW

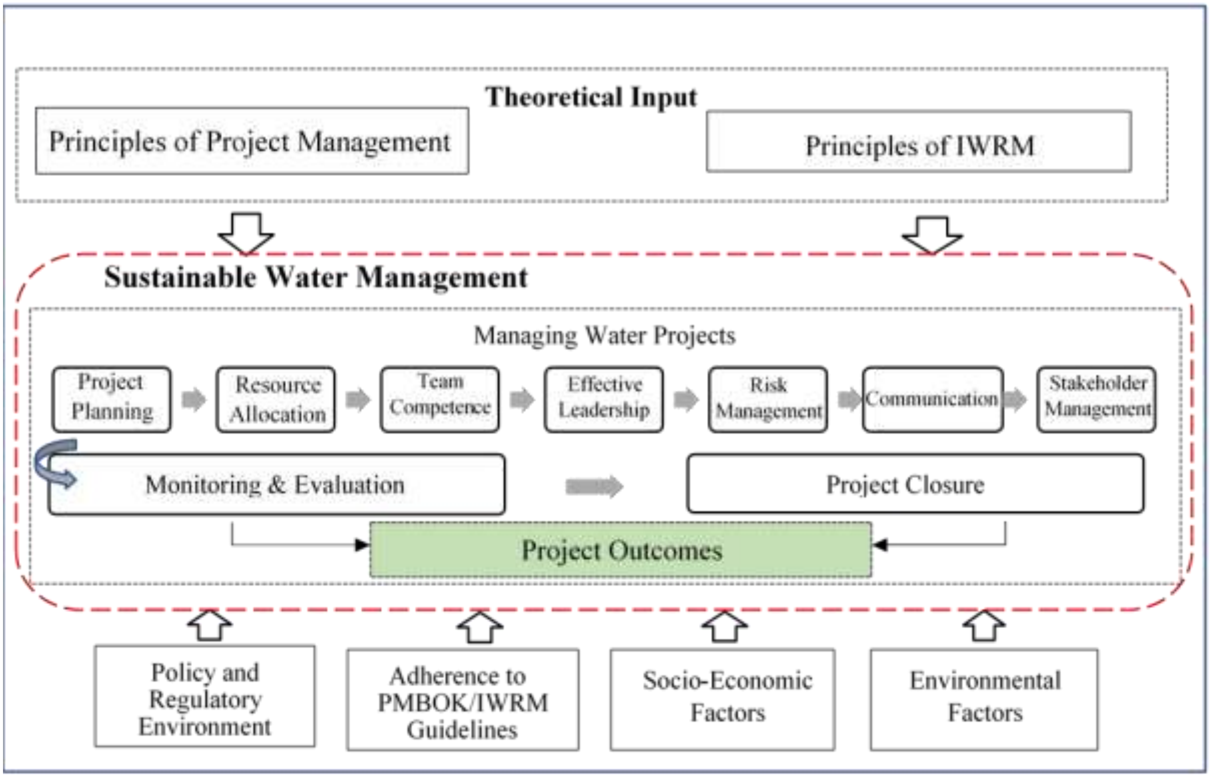
## Project Management and Water Resources Theories

The study is grounded in Project Management theory (Verzuh, E. ,2015; Project Management Institute, 2021) together with Integrated Water Resources Management (IWRM) (UNESCO, 2024) to provide an analytical lens for studying water sector project sustainability in semi-arid contexts (Hambira, 2007). Project Management theory defines projects as structured, goal-based processes which use planning, execution, monitoring and control mechanisms to determine their delivery performance (Cleland, 1999). The framework demonstrates that leadership capability, stakeholder coordination, communication, risk management and institutional support serve as critical elements that determine project success (Pinto & Slevin, 1987).

IWRM, by contrast, emphasises the coordinated management of water, land, and related resources to optimise social and economic welfare without compromising ecosystem sustainability (Rahm, et al., 2006; Global Water Partnership, 2000). Botswana has formally adopted IWRM principles through the National Water Policy (BNWP, 2012), the Botswana IWRM–WE Plan (2013), and regional SADC frameworks (SADC, 2001a). These instruments position integration, participation, and adaptive management as central to sustainable water governance.

Integrating these two theoretical frameworks creates a robust foundation for analysing how managerial processes interact with institutional and environmental governance. This intersection is particularly relevant in Botswana, where gaps in coordination and implementation often hinder policy objectives. Consequently, the conceptual framework (*Figure 1*) defines project performance as a direct outcome of this interplay, shaped by the influence of critical success factors and localised challenges.

**Figure 1**: **Project Management and IWRM Interplay Conceptual Framework**




## Sustainability in Water-Sector Projects

Water resources projects consist of complex systems which bring together technical elements with social and administrative components that link engineering to governance and community structures (Hambira, 2007). Sustainability in semi-arid contexts needs the development of infrastructure systems alongside long-term financial, operational success and institutional stability (Atkinson, 1999). Research data shows that project management effectiveness stands as a crucial element which determines between successful water infrastructure investments that produce lasting results and unsuccessful investments that fail to achieve their expected lifespan (Müller & Lecoeuvre, 2014; Shenhar et al.,2016).

In developing countries, the construction projects delays, cost over-runs and system failures postconstruction dysfunctionality result from three main factors which include inadequate planning, fragmented leadership, insufficient stakeholder participation, and institutional viability (Ofori, 2013; Ika & Hodgson, 2014). These documented challenges affect the African water sector since infrastructure development initiatives have failed to enhance service delivery according to the African Development Bank (2018). The idea of sustainability today functions as a management and governance outcome that extends beyond its initial role as a technological solution (Lockwood, 2017).

**Critical Success Factors in Project Management**

The Critical Success Factors (CSFs) provide a structured approach that enables organisations to identify their crucial managerial and institutional conditions that impacts their project outcomes (Pinto & Slevin, 1987; Belassi & Tukel, 1996; Westerveld, 2003). Hambira (2007) extends this framework to watersector projects, highlighting communication, leadership competence, organisational support, stakeholder involvement, and risk management as central drivers of success.

In water resources management, CSFs are further influenced by alignment with environmental and socio-economic objectives, participatory decision-making processes, and adaptive capacity to climatic uncertainties (Medema et al., 2008). Identifying and prioritising these factors is particularly crucial in Botswana, where project managers operate within complex regulatory, institutional, and climatic constraints. This study therefore employs this CSF framework to empirically evaluate the key elements most significantly influence sustainability outcomes in the national water sector.

**Contextual and Institutional Challenges**

Semi-arid environments such as Botswana are characterised by high rainfall variability (ranges from over 650mm in the northeast to less than 250mm in the southwest), prolonged droughts and elevated evaporation rates (Batisani, & Yarnal, 2010), which intensify water scarcity and system vulnerability (Rockström et al., 2009; IPCC, 2019). These biophysical constraints intersect with rising urban demand and agricultural pressures, amplifying exposure to project failure risks (Mekonnen & Hoekstra, 2016).

Regional (SADC) studies indicate that environmental stressors are compounded by institutional and managerial deficiencies, notably inadequate integration between policy objectives and project-level implementation (van der Zaag & Gupta, 2008; BIWRM–WE Plan, 2013). As a result, sustainability outcomes are influenced not only by water availability but by the effectiveness of planning, coordination, monitoring, and adaptive decision-making integrated within project management frameworks.

**Governance, Coordination, and Stakeholder Engagement**

Effective governance, coordination, and stakeholder engagement form the structural foundation for sustainable water project delivery (Moyo, 2019; Organisation for Economic Co-operation and Development, 2015). Specifically, project governance mechanisms that clarify roles and coordinate relationships are critical for success (Ma, 2020). Furthermore, moving from top-down management to collaborative governance requires well-structured and inclusive stakeholder networks (Hong, 2024), as tailored engagement is imperative for resolving conflicts and securing project legitimacy (Meyer et al., 2024).

Therefore, effective governance is critical for the success of sustainable water initiatives, especially in semi-arid regions where trade-offs among competing users are inevitable (Biswas, 2008; Bekker & Steyn, 2019). Botswana's governance framework prioritises policy consistency, regulatory clarity, and multi-tiered coordination, as implemented through the National Water Policy and associated instruments (BNWP, 2012).

However, institutional fragmentation across the water, agricultural, land, and environmental sectors continues to pose significant challenges (Global Water Partnership, 2015). Horizontal coordination across ministries and vertical alignment with district and community-level entities are essential for effectively putting policy into practise (Kulkarni, 2022). Similarly, multistakeholder participation promotes legitimacy, incorporates local knowledge, and mitigates conflict, thereby reinforcing the long-term sustainability of projects (Reed, 2008; Sigalla et al., 2021). At local level, participatory governance holds special significance in Botswana through where traditional institutions (*kgotla* system) are integral to local water management. A *Kgotla* system is a public meeting for discussing community issues, laws, and administration. Traditionally led by the Chief (*Kgosi*), the *Kgotla* also handles both civil and minor criminal cases. In addition, it provides a platform for chiefs to manage tribes and receive community feedback, guided by customary law (Ngwenya & Kgathi, 2011).

**Innovation and Technological Adoption**

Technological innovation is increasingly recognised as a complementary CSF for water projects in semi-arid regions (Dai, et al., 2025; Humnabadkar, et al., 2018), supporting demand management, system monitoring, and operational resilience (Zhao et al., 2025). Advances such as smart metering, remote sensing, and advanced treatment technologies have demonstrated effectiveness in waterstressed contexts, including Southern Africa (Bull et al., 2020; Qiblawey et al., 2019). Botswana through Water Utilities Corporation (WUC) adoption of smart prepaid water metering reflects this trend (Botswana Press Agency [BOPA], 2024). The solution implements LoRaWAN technology to achieve real-time leak detection and better supply management in addition to its smart metering capabilities. The initiative achieved recognised success which established it as the leading innovative project throughout the region. This status is shown by the formal benchmarking visit made in June 2025 by Namibia's water provider, NamWater, which aimed to gather insights for its own technical deployment (Nambusinessexpress.com, 2025). The path to technological success demands institutions to build their capabilities while their funding systems and human skill acquisition abilities need to progress (UNESCO, 2021). Innovation therefore functions not as an isolated solution, but as part of an integrated project management ecosystem.

**Synthesis of Research Gaps and Rationale**

The study findings reveal a fragmented understanding of sustainability in water-sector projects. Although there has been a number of studies on CSFs, governance, stakeholder engagement and innovation individually, there is limited empirical evidence about their combined effects on project outcomes in developing semi-arid contexts. Existing research often treats these elements in isolation, limiting their practical applicability (Mvungi & Mabamba, 2021; Zhao et al., 2025).

This study contends that these isolated elements are more effectively comprehended as potential sources of project-level friction—the misalignment between policy intent and execution capacity that accumulates at the interfaces where governance, coordination, participation, and innovation intersect with on-the-ground realities. When these elements function harmoniously, friction is minimized and projects succeed. When they misalign—when policy literacy outpaces execution capacity, or when stakeholder engagement remains tokenistic—friction accumulates and underperformance follows.

Therefore, this study fills this knowledge gap through its integrated CSF framework which studies Botswana's water sector to understand how governance, institutional coordination, stakeholder participation, and innovation work together to achieve sustainable outcomes. By conceptualizing project success as the reduction of friction across these domains, the framework offers a diagnostic lens for identifying where and why implementation gaps emerge. The conceptual framework (Figure 2) demonstrates how project success develops through the combined effects of these elements which function in a semi-arid national setting to produce research data that directs policy creation.

Research has documented CSFs and governance and stakeholder engagement and innovation separately but there is limited empirical evidence about their combined effects on project results in developing semi-arid regions. Research studies currently study these elements independently which makes their useful applications restricted (Mvungi & Mabamba, 2021; Zhao et al., 2025). The research fills this knowledge gap through an integrated CSF framework which studies Botswana's water sector to determine how governance and

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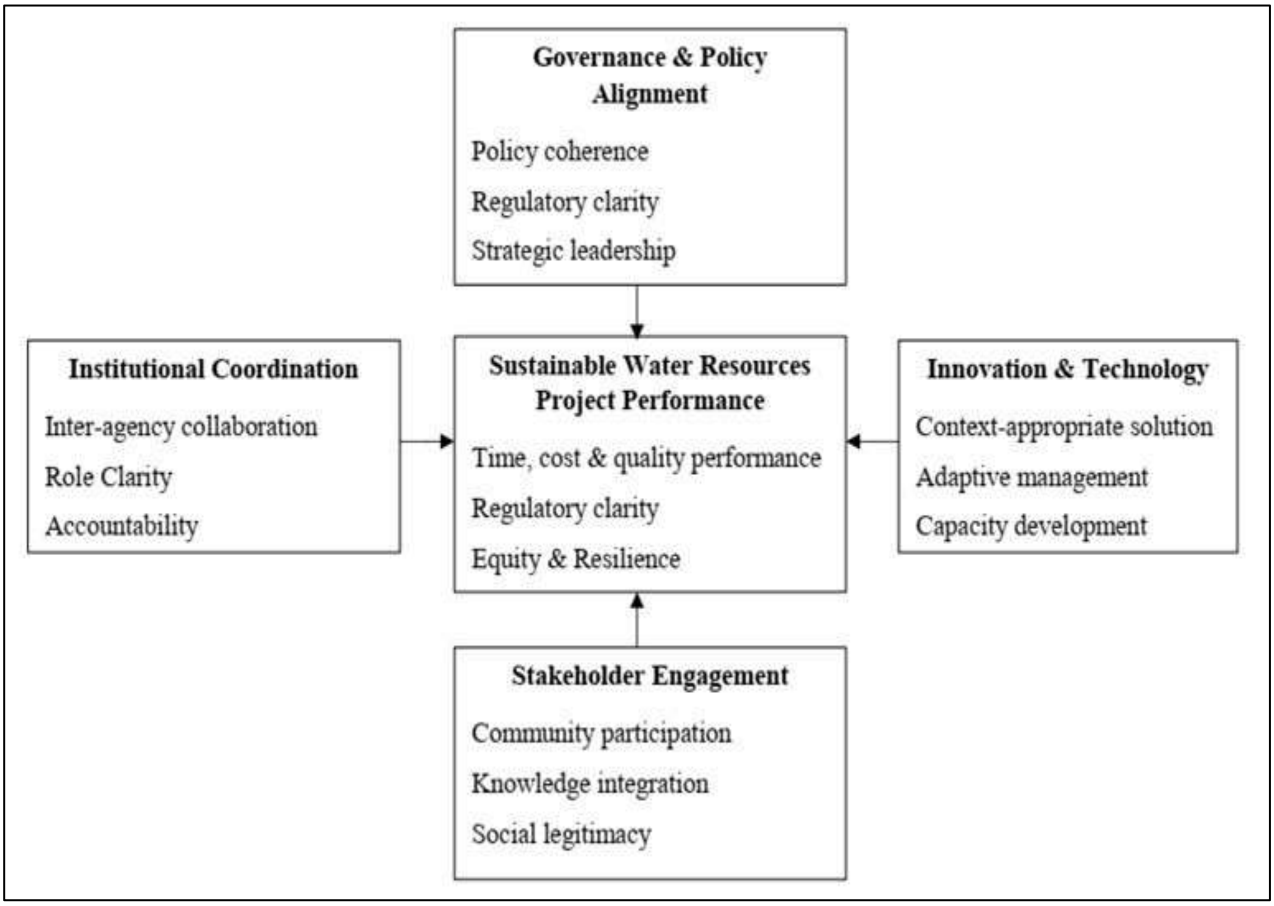
institutional coordination and stakeholder engagement and innovation work together to achieve sustainability results. The conceptual framework (*Figure 2*) therefore conceptualises project success as a function of the dynamic interplay between these pillars within a semi-arid national context, establishing a basis for empirically grounded and policy-relevant insights.

**Figure 2. Conceptual framework for sustainable water resources project management**




## RESEARCH METHODOLOGY

### Research Design and Philosophical Orientation

The research design of this study employed quantitative methods to study project management practices which impact water resource project sustainability in Botswana through a cross-sectional research design. The design is appropriate for studies seeking to measure perceptions, rank factors, and establish relative importance of predefined variables across a professional population at a single point in time. The research field of Critical Success Factor (CSF) employs quantitative methods to study project outcome factors because these methods enable scientists to assess and prioritisation of factors influencing project outcomes (Gündüz, & Almuajebh, 2020).

The study is grounded in a pragmatic research philosophy, focusing on generating empirically grounded and decision-oriented knowledge relevant to practitioners and policymakers. The approach prioritises analytical clarity and applicability over theory testing, consistent with applied infrastructure and project management research in developing-country contexts.

### Case Study Context and Justification

The empirical focus of the study is Botswana's water sector, examined as a single embedded case. Botswana exemplifies a critical case due to its semi-arid climate which necessitates greater water resources while contending with persistent challenges in attaining sustainable success through its advanced water management strategies. The single-case approach was adopted as it enables comprehensive contextualisation (Willis, 2014; Bennett & Elman, 2007; Yin 2009) while keeping the analysis organised for projects that share the same institutional environment, climatic and policy contexts. Botswana's water sector is governed by Integrated Water Resources Management (IWRM) principles incorporated in the National Water Master Plan (Department of Water Affairs, 2013). Despite this comprehensive policy framework in national water management, implementation challenges persist, rendering the context appropriate for exploring the Critical Success Factors that bridge the policy–practice gap in water infrastructure delivery.

**Population and Sampling**

A purposive sampling technique was employed for this study to target respondents (*Table 1*) with direct experience relevant to the study's objectives, a method considered appropriate for exploratory research aiming to gather expert insights (Dworkin, 2012; Taherdoost, 2016). A sample size of *fifteen respondents (N = 15)* was considered adequate for an expert-based CSF study, consistent with prior infrastructure and project management research where respondent expertise outweighs statistical generalisation. The diversity of professional roles ensured coverage of technical, managerial, and institutional perspectives.

**Table 1: Professional Roles of Respondents (N=15)**

| Professional Role | Frequency | Percentage (%) |
|---|---|---|
| Engineer | 5 | 33.3 |
| Project Manager | 4 | 26.7 |
| Project Team Member | 4 | 26.7 |
| Environmental Specialist | 2 | 13.0 |
| Policy Planner/ Developer | 0 | 0.0 |

**Data Collection**

A convergent mixed-methods design was used for data collection via a *structured questionnaire* as the primary instrument and disseminated electronically to ensure broad reach and efficient data capture. The questionnaire based on established CSF frameworks, asked respondents to assess issues using a five-point Likert scale (from 'Very Low' to 'Very High Importance'). In order to contextualise and triangulate these findings, secondary data were systematically collected through a comprehensive desk-based review of existing literature, national policy documents, and water sector reports.

**Data Analysis**

Data analysis was conducted using a mixed-method approach, combining quantitative and qualitative techniques to enhance analytical depth and triangulation. Quantitative data obtained from the structured questionnaire were coded, cleaned, and analysed using PSPP statistical software. Descriptive statistics were first applied to summarise respondent characteristics and identify general response patterns.

The Relative Importance Index (RII) method constituted the primary analytical technique and was used to rank the identified Critical Success Factors and project management challenges based on respondents' perceived importance. The RII approach is widely used as a research method in construction and project management studies because of its robustness in prioritisation research and suitability for Likert-scale data (Gündüz et al.,2020). Supplementary inferential analyses were conducted where applicable to explore patterns and relationships within the dataset, offering additional contextual interpretation of the findings. Qualitative inputs gathered through expert engagement and desk-based review were analysed thematically to support interpretation of quantitative findings and to contextualise the empirical rankings within known project management and sustainable water governance literature.

**Alignment with Research Objectives**

The study design used a convergent mixed-methods approach (Creswell & Plano Clark, 2018), combining quantitative and qualitative data to provide a comprehensive analysis. The cross-sectional survey design enabled systematic assessment of current project management practices among sector professionals, thereby fulfilling SO1. The analysis of this survey data, utilising techniques like the Relative Importance Index (RII), facilitated the identification and empirical ranking of the key challenges hindering project sustainability, directly achieving SO2. The study employed purposive sampling to choose knowledgeable respondents (Taherdoost, 2016) yielded the expert insights necessary to examine gaps between policy intent and execution (SO4) and to identify actionable Critical Success Factors (CSFs) for improvement (SO3). This synthesis of primary survey data with secondary policy analysis ensured the findings are empirically grounded, contextually relevant to Botswana's semi-arid environment, and immediately suitable for informing strategic interventions within the national water sector.

## STUDY FINDINGS AND DISCUSSION

### Profile of Respondents and Analytical Context

The empirical findings are derived on insights provided by experts actively involved in Botswana's water sector initiatives. The survey results showed that engineers made up the biggest group of participants at 33.3% while project managers and team members each accounted for 26.7% and environmental specialists made up 13.3% of the total participants. The study's findings indicate that no participant selected "policy planner" as their designated function, since all participants concentrated on the technical aspects of project execution. This absence is itself revealing: it suggests a separation between policy design and project implementation—a potential source of friction where strategic intent meets operational reality. The survey results showed that 40% of survey participants worked in their chosen field for more than ten years but 33.3% of participants worked in their field for between six and ten years. The research findings stem from experienced professionals who validate the following empirical results through their institutional and project operational expertise.

### Empirical Findings on Critical Success Factors

An empirical study of critical success factors affecting the sustainability of water sector initiatives in Botswana shows that most project underperformance stem from deficiencies in governance, leadership together with execution problems instead of technical issues. (see *Table 2*). Respondents identified a consistent disconnect between planning frameworks and execution discipline, supporting the idea that project management methodologies alone do not ensure success unless effectively operationalised. This disconnect is a classic manifestation of project-level friction: the gap between what policies prescribe and what project teams can deliver. In addressing *Objective 3*, the prioritisation of robust project leadership, the employment of qualified personnel, and contractor training emphasises the vital role of human capital in converting project plans into successful outcomes.

These findings are consistent with the view of Kerzner (2017), who posits that leadership acts as an integrating mechanism throughout the project lifecycle, especially during the implementation phase where capacity constraints are most pronounced. Additionally, the importance assigned to contractor related aspects corresponds with the argument presented by Flyvbjerg (2014), indicating that shortcomings in initial planning and management decision-making often result in challenges later in the project.

This study contributes to the body of knowledge in project management and water governance by empirically investigating the critical success factors (CSFs) that influence the sustainability of water sector initiatives in Botswana. The findings presented in (see *Table 2*) suggest that project underperformance is primarily influenced by weaknesses in governance, leadership, and implementation rather than technical deficiencies. In relation to *Objective 1*, a consistent disconnect between established planning frameworks and execution discipline was identified by respondents. This observation reinforces the assertion by Atkinson (1999) that the simple existence of project management methodologies cannot guarantee success unless they are effectively operationalised in practice.

**Table 2: Rated Importance of Critical Success Factors in Water Management Projects**

| Rank | Success factor | Mean rating | RII | Importance level |
|---|---|---|---|---|
| 1 | Use of qualified manpower | 4.9 | 0.98 | very high |

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| | | | | |
|---|---|---|---|---|
| 2 | Strong project leadership | 4.8 | 0.96 | very high |
| 3 | Training contractors in PM | 4.7 | 0.94 | very high |
| 4 | Involve stakeholders in decisions making | 4.6 | 0.92 | very high |
| 5 | Stakeholders engagement | 4.5 | 0.90 | very high |
| 6 | Use of appropriate PM tools | 4.1 | 0.82 | high |

*Note*. RII = Relative Importance Index; RII = Mean/5. Ratings were based on five-point Likert scale ranging from 1(very low importance) to 5 (very high importance), N = 15, PM = Project Management

Stakeholder engagement also emerged as a highly ranked success factor, underscoring the significance of participatory governance in enhancing legitimacy, reducing resistance, and improving sustainability in community-dependent water infrastructure projects (Reed, 2008). The relatively lower emphasis was placed on project management tools that suggests that technology-based solutions are insufficient unless when they used by competent user within the organisational system. The research findings confirm Pollack and Adler (2015) position that tools derive their effectiveness from the competencies of those who apply them. Overall, the results point to a systemic interplay between leadership quality, institutional governance, and implementation capacity as the primary determinants of sustainable water sector project performance. Where these elements align, friction is minimized; where they misalign, it accumulates—manifesting as the delays, cost overruns, and operational failures documented in this study.

**Analysis of Systemic Challenges**

This section outlines analysis of the systemic challenges impending the implementation of water sector project in Botswana (see *Table 3* for a summary). The study findings clearly suggest that project underperformance is a result of structural deficiencies in planning, financing, and governance—it's much more than just isolated operational errors. These deficiencies represent concentrated points of friction where the project system consistently fails**.** The outcome addressed the study's *Objective 2: Analysing systemic constraints on project sustainability*. From the findings, it was observed that improper planning by contractors came out as the single most significant constraint, then followed by poor performance from senior management and insufficient funding. The sheer prevalence of these factors highlights exactly how vulnerable projects are during those critical early lifecycle stages. Other critical factors emphasised during the initial planning phases of the project include weak scope definition, unrealistic scheduling, and ineffective decision-making, all create risks that simply build up and cause problems further downstream. This accumulation of risk across project stages is friction in motion, each misalignment adding resistance to the system. This pattern aligns entirely with existing studies, specifically the identification of planning fallacies and optimism bias as primary drivers of project failure by Flyvbjerg (2014).

The study results underscore financial constraints—particularly insufficient financing and inadequate donor funds—as very significant, emphasising the direct correlation between a project's fiscal capacities and the overall quality of implementation. Respondents associated these funding shortfalls with crucial issues like delayed procurement, compromised supervision, and weakened quality control. This conclusion strongly supports the study conducted by Ika and Hodgson (2014) about public-sector infrastructure in developing regions.

According to the respondents, performance risks are also exacerbated by human errors at project operation phase and human resource challenges, these include: poorly trained personnel, weak site management, and the unavailability of equipment. In addition, these factors underscore institutional capacity limitations common in developing countries and align with the multidimensional model proposed by Belassi and Tukel (1996), which stresses that project outcomes are shaped by the interaction of managerial, organisational, and environmental factors.

Although stakeholder disengagement and infrastructure constraints ranked lower, they still present substantial challenges that highlight deficiencies in early engagement and contextual planning. The findings indicate that

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insufficient involvement of stakeholders undermines both project acceptability and long-term sustainability, this aligns with Reed's (2008) research, which asserts that early stakeholder engagement in environmental decision-making is increasingly sought after and integrated into both national and international policies. Overall, the results demonstrate that the challenges facing water sector projects in Botswana are systemic and cumulative—conceptualised friction emerging from the interplay of multiple interacting constraints rather than any single point of failure. The requirement for enhanced leadership, disciplined planning, financial readiness, and institutional coordination to improve sustainable project performance is further supported by the clear alignment observed between these constraints and the identified critical success factors.

Taken together, these findings (*Table 3*) directly address *Objectives 1* and *2* by demonstrating that perceived weaknesses in project management effectiveness and the prevalence of planning-, leadership-, and finance-related constraints are structurally linked, thereby explaining persistent underperformance in Botswana's water sector projects.

**Table 3: Rated Challenges Affecting Water Management Projects**

| Rank | Challenge Category | Mean Rating (1-5) |
|---|---|---|
| 1 | Contractors improper planning | 4.3 |
| 2 | Lack of funding | 4.2 |
| 3 | Poor performance by project leadership | 4.2 |
| 4 | Poorly trained manpower | 4.2 |
| 5 | Poor site management | 4.1 |
| 6 | Equipment unavailability and failures | 4.1 |
| 7 | Limited site resources | 4.0 |
| 8 | Infrastructure constraints | 4.0 |
| 9 | Inadequate client finances | 3.9 |
| 10 | Resistance from stakeholders | 3.8 |
| 11 | Poor definition of project requirements | 3.8 |

**Statistical Relationships, Patterns, and Implications**

This section explores the connections between the critical success factors (CSFs) identified in the study, systemic challenges, and how they relate to project outcomes. Since much of the data relied on ordinal ratings (like "high importance" or "low effectiveness"), the Spearman Rank Correlation Coefficient ($\rho$) was adopted to specifically assess for monotonic correlations between these variables. Given that the variables of interest were measured on an ordinal scale, the Spearman Rank Correlation Coefficient ($\rho$) was selected as the appropriate nonparametric measure of association. This approach is specifically recommended for data that have a defined order or ranking but do not necessarily meet the normality assumptions required for parametric tests like Pearson's $r$ (Howell, 2010; Corder & Foreman, 2014).

This approach enables to determine if a higher rank in one area generally predicts a higher (or lower) rank in another, without assuming a strict linear relationship. The goal here is to bridge the gap between perceived importance and measured effectiveness. The key results of these analyses are provided in *Table 4*.

**Table 4**: **Summary of Spearman Correlation Results for Key Variable Pairs**

| Variable pair | Correlation metric | Value ($\rho$) | Interpretation |
|---|---|---|---|
| **Pair 1:** Policy Familiarity & Project Effectiveness | Spearman's rho | 0.72 | Strong positive correlation |

| | | | |
|---|---|---|---|
| **Pair 2:** Leadership Importance & Monitoring Effectiveness | Spearman's rho | 0.42 | Moderate positive correlation |
| **Pair 3:** Engagement Importance & Project Effectiveness | Spearman's rho | 0.94 | Very strong positive correlation |

**Pair 1: Familiarity with Water Policies and Project Effectiveness**

A strong, positive correlation was found between practitioners' familiarity with national water policies and their perception of effective project management ($\rho$=0.72). This outcome indicates that knowing the regulations significantly enhances implementation quality. This finding pinpoints a key friction point: where policy literacy is low, the gap between intent and execution widens, it further lines up well with governance-performance frameworks, such as those proposed by Too and Weaver (2014), which argue that success depends on matching formal policies with real-world practices. Similarly, Müller et al. (2012) make the point that governance structures only become valuable when project managers and the technical team on the ground actually understand the institutional knowledge needed to make them work.

**Pair 2: Leadership Importance and Monitoring Effective**

The study indicated a modest positive correlation between the perceived importance of strong leadership and the effectiveness of project monitoring ($\rho$=0.42) and despite the relationship's existence, this moderate strength suggests a gap between acknowledging leadership's theoretical function and its consistent implementation within actual project supervision and monitoring measures. This gap— between recognition and realization— is friction internalized: knowing what matters without being able to make it matter. This finding aligns strongly with Kerzner's (2017) project management maturity model, which takes leadership as a cultural driver and as a prerequisite for effective monitoring and control systems committed to project management excellence. This view complements Müller and Lecoeuvre's (2014) argument that leadership acts as a governance mechanism which facilitates the translation of strategic objectives into operational control. While this relationship is apparent within this framework, its influence does not seem to be particularly pronounced.

**Pair 3: Stakeholder Engagement Importance and Project Effectiveness**

The study findings indicate that stakeholder participation is crucial determinant of project success, this was observed by a very strong positive correlation between its importance and overall project effectiveness (ρ=0.94). This almost optimal correlation underscores stakeholder engagement as a critical factor in the success of community-dependent water infrastructure projects. When engagement is high, friction between project goals and community expectations nearly disappears. The result is consistent with participatory governance theory and the work of Müller et al. (2012), who identify stakeholder integration as a core dimension of project governance. The conclusions of this study were similarly established by Too and Weaver (2014) in their research, which highlighted that stakeholder engagement as a critical mechanism for ensuring sustainability in public infrastructure projects by enhancing legitimacy and reducing community resistance.

## CONCLUSION

The objective of this study was to bridge a critical gap between policy intent and practical project execution within Botswana's water sector—and by extension, in other developing semi-arid countries— by empirically identifying the Critical Success Factors (CSFs) essential for sustainable project completion. This gap, conceptualized throughout as project-level friction, represents the accumulation of barriers where governance, capacity, and execution misalign. By using a mixed-methods approach, the study's analytical focus was redirected from technological solutions to foundational governance and management processes highlighting the main obstacles to effective project outcomes being systemic and institutional, rather than purely technical in nature; this conclusion fundamentally challenges conventional infrastructure implementation paradigms prevalent in the region.

**Key Findings and Implications**

The study identified three primary challenges that function as significant barriers to success: insufficient planning during initial stages, weak leadership capacity, and inadequate financial resources. Each of these represents a distinct point of friction, places where policy intent encounters operational reality and fails to translate. These factors are highly interdependent; for example, budgetary deficiencies often result in design compromises and inadequate planning, which are subsequently intensified by insufficient management control. Friction, therefore, is not singular but cumulative, amplifying as it moves through the project lifecycle.

The findings from *Section 4.4* show that project governance systems along with human capital management practices function as key elements that contribute highly to the success of sustainability projects. The correlation between policy literacy and project effectiveness demonstrates a strong relationship ($\rho$=0.72) which shows that operational practices require institutional knowledge for their success (Too & Weaver, 2014). Where policy literacy is low, friction is high and the gap between knowing and doing widens. The very strong correlation between stakeholder engagement and project effectiveness ($\rho$=0.94) confirms that participatory governance is a critical mechanism for legitimacy and long-term sustainability (Müller et al., 2012). Engagement, conversely, reduces friction by aligning project goals with community expectations.

The research findings show although advanced technologies are crucial for water resources sustainability, proper project management, stakeholder coordination, and institutional capacity are essential to achieve their maximum benefits. Therefore, transformative potential of water projects lies not in deploying more technology alone, but in strengthening the human and institutional frameworks that govern them. This study has shown that project-level friction is diagnosable, measurable, and— critically—addressable. By identifying where friction accumulates, practitioners and policymakers can target interventions not at symptoms but at the systemic misalignments that produce them.

## Study Limitations and Challenges

The research offers valuable insights that support the sustainability of water sector programs; however, there several limitations that must be acknowledged. The small research population ($N$=15) was used for quantitative analysis, this limited sample size limits the generalisability of the findings and the statistical power of certain tests. The sector experts who reported their effectiveness perceptions through self-assessment methods might have introduced common method bias (CMB) into the study. Furthermore, the scope was also limited exclusively to the Botswanan context; thus, caution must be exercised when directly transferring these specific findings to other regional contexts without further validation.

## Recommendations and Future Research Directions

The study provides a context-specific, practical approach for policymakers together with project managers by shifting the focus from the deployment of physical infrastructure to governance mechanism that ensure long-term water sustainability. Recommendations for improvement include project leadership training, improved financial preparedness procedures, and strengthening of stakeholder engagement strategies throughout the project lifecycle.

Although grounded in Botswana's semi-arid environment, the analytical approach offers transferable insights for similar contexts applicable to comparable contexts facing common challenges of implementing Integrated Water Resource Management (IWRM) principles through efficient project execution. In order to achieve water sustainability, it requires a concurrent investment in governance, leadership, and meticulous planning alongside the development of physical infrastructure. Future studies should focus on validating the proposed framework through extensive quantitative studies across the region and other semi-arid developing countries together with longitudinal studies to monitor the long-term effectiveness of specific interventions to provide empirical evidence of their impact on sustainable project outcomes.

## Declarations

## Author Contributions

The author managed all stages of the paper, including its conceptualisation, methodology development, validation, formal analysis, investigation, writing, and final review.

**Institutional Review Board Statement**

Ethical review and approval were waived for this study, as the research did not involve vulnerable populations or sensitive personal data.

**Informed Consent Statement**

Informed consent was obtained from all participants involved in the study.

**Data Availability Statement**

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to confidentiality considerations.

**Conflicts of Interest**

The author declares no conflict of interest.

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